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HCP-to-FCC Transitions in Group VIII Elements at High Pressures and Temperatures*

C. S. YOO, H. CYNN, LLNL- The hcp-to-fcc phase transitions of the group VIII elements, Fe, Co and Ni, have been studied at high pressures and temperatures by using *in-situ* synchrotron x-ray diffraction coupled with a diamond-anvil cell laser-heating technology. In these elements, the hcp-to-fcc transition systematically occurs at high temperatures at high pressures. For example, the $\Delta T/\Delta P$ slope of the transition rapidly decreases from Fe to Co to Ni. Consequently, the fcc phase of γ-Fe disappears at the liquid/fcc/hcp triple point near 50±10 GPa and 2600±200 K; whereas, the fcc phase of β-Co is stable at high temperatures at high pressures well above 100 GPa. The fcc phase of Ni is stable even at ambient temperature at high pressures. The high temperature fcc phases of β-Co and γ-Fe are quenchable at low temperatures. On the other hand, the fcc-to-hcp transitions in Co and Fe are rather complicated at low pressures below 40 GPa due to a metastable dhcp structure formed during the transition. In this paper, we will present the x-ray data of iron and cobalt and, then, discuss about the systematics of the hcp-to-fcc transitions in Group VIII elements and the metastability of the dhcp phases.

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